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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/821,753	03/30/2001	Tuqiang Ni	2328-053	5171

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9
EXAMINER

ALEJANDRO MULERO, LUZ L

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 08/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/821,753

Applicant(s)

NI ET AL.

Examiner

Luz L. Alejandro

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 14-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 17-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restriction

Claims 14-16 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant traversed the restriction (election) requirement. The traversal is on the ground(s) that the subject matter of claims 14-16 and 29 is not independent and distinct from the remaining claims since the limitations of the claims are essentially the same as those of the remaining claims. This is not found persuasive since the limitations of the claims are not essentially the same as the limitations of the remaining claims. As stated in the office action dated 09/29/02, claims 1-13 and 17-22, and claims 14-16, are directed to different inventions. Claims 1-13 and 17-22 are directed to a method of processing and claims 14-16 are directed to an apparatus. Furthermore, the process as claimed can be practiced by hand by the operator gradually changing the amount of AC power applied to the plasma. Therefore, the arguments are not persuasive.

The requirement is still deemed proper and is therefore made FINAL.

Furthermore, it should be noted that claim 29 depends on claim 19 and not on claim 14, as applicant argues on the paragraph bridging pages 8-9 of the amendment filed 06/11/03. Therefore, newly added claim 29 has not been withdrawn from consideration, instead the claim has been examined on the merits.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-13 and 17-29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification, as originally filed, fails to provide support for the limitation of gradually changing the amount of AC power supplied to the plasma during processing of the workpiece "while the power is in a steady state condition subsequent to power start up and prior to the beginning of power shut down".

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 20-22, 25, and 28-29 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 20, 25, 28 and 29, recite the phrase "The program" in line 1. However, the claims depend on claim 19, which depend on claim 17. Claim 17, as amended,

Art Unit: 1763

recites "A memory". It seems that "The program" should read -- The memory -- for a clear understanding of the claimed invention. Note that claims 18-19 and 21-22, which also depend, directly or indirectly, on claim 17, were properly amended to recite the phrase "The memory".

Claim 29 recites the limitation "the controller" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-13 and 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al., U.S. Patent 5,807,789 in view of Tsuchiya et al., U.S. Patent 5,716,534 and further in view of Howald et al., WO 00/58992.

Chen et al. shows the process substantially as claimed including forming a trench through plasma etching where the RF power is changed and the flow rate and the species are not changed in order to form a trench with a tapered profile and rounded corners at an intersection of a wall and a base of a trench in response to the power change (see col. 2-line 64 to col. 4-line 30).

Chen et al. fails to expressly disclose: 1) where the change in RF power is substantially continuous and gradual, for example, the power change including steps having power changes no greater than about several watts, the power remaining at a constant wattage for no more than about one millisecond or for about one millisecond to one second, 2) wherein the gradual change is pre-programmed while no change occurs in the pressure, 3) wherein the AC power is supplied by an electrode coupling an AC electric field to plasma in the chamber, the electrode being responsive to an AC power source that supplies RF bias to the electrode that is on a holder for the workpiece, the AC power supplied by a coil coupling a RF plasma electromagnetic field to the chamber, 4) the vacuum chamber being subject to operating at different pressures while the workpiece is being processed, and 5) the gas species being subject to flowing into the chamber at different flow rates while the workpiece is being processed.

Tsuchiya et al. discloses a process whereby during an etching process the RF power is either changed in a step-wise manner or gradually changed subsequent to

Art Unit: 1763

power start up and prior to the beginning of power shut down in order to provide, for example, a hole or sidewall with tapered sides (see col. 12-line 6 to col. 13-line 37). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Chen et al. as disclosed by Tsuchiya et al. so as to gradually change the power because Tsuchiya et al. discloses that gradual changes in the power can be performed for fine control of the process (see figs. 32-33 and col. 13-lines 16-27). With respect to the specific time period to which the power remains at constant wattage and the amount the power is changed, it would have been obvious to determine through routine experimentation the optimum amount of time at which the power should remain constant and the optimum amount the power is changed, to achieve the desired rounded profile of the trench and would not lend patentability to the instant application absent the showing of unexpected results.

Furthermore, Howald et al. discloses a method of processing by etching (see page 1-lines 15-19) a workpiece in a vacuum plasma processor chamber including computers 20 and 34 and wherein a gas species is converted into an AC plasma (see page 6-lines 17-20), the vacuum chamber being subject to operating at different pressures while the workpiece is being processed, the gas species being subject to flowing into the chamber at different flow rates while the workpiece is being processed (see page 2, lines 15-22). Note also that the AC power is supplied by an electrode 56 being on a holder for the workpiece and the electrode is responsive to an AC power source that is supplied by a coil 48 coupling an RF plasma excitation field to the chamber. In view of this disclosure, it would have been obvious to one of ordinary skill

Art Unit: 1763

in the art at the time the invention was made to modify the process of Chen et al. modified by Tsuchiya et al. so as to include a process using the apparatus of Howald et al. because such an apparatus allows for a high level of control over the plasma process being performed. Moreover, with respect to the changes in power being pre-programmed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to pre-program the power change into the microprocessors 20,34 of Howald et al. because in such a way operator error will be eliminated. Moreover, merely using a computer to automate a known process does not by itself impart nonobviousness to the invention. See *Dann v. Johnston*, 425 U.S. 219, 227-30, 189 USPQ 257, 261 (1976); *In re Venner*, 262 F.2d 91, 95, 120 USPQ 193, 194 (CCPA 1958).

Response to Arguments

Applicant's arguments filed 6/11/03 have been fully considered but they are not persuasive.

Applicant argues that the combination of Chen et al., U.S. Patent 5,807,789, Tsuchiya et al., U.S. Patent 5,716,534, and Howald et al., WO 00/58992 is improper because Tsuchiya et al. fails to show gradually changing the power subsequent to start up and prior to shut down. However, note from the description in Tsuchiya et al. that during the time the power is gradually changed, etching gas and the wafer are still in the chamber, plasma continues to be generated, and therefore etching still takes place during the time the power is gradually changed (see col. 12-line 58 to col. 13-line 27).

Art Unit: 1763

Additionally, note that Tsuchiya et al. discloses that the method can be used in order to tailor the taper angle of an etched hole, which is precisely what is being performed in applicant's invention.

With respect to claims 7, 15, and 19, as stated above, Tsuchiya et al. discloses that the method of the invention can be used in order to tailor the taper angle of an etched hole.

Concerning claims 8 and 20, regarding the fact that Chen et al. fails to disclose a process in which a gradual power change creates a rounded corner, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The Tsuchiya et al. reference is relied upon to show performing a plasma process in which the power is gradually changed.

Regarding the particular steps of power change, note that Tsuchiya et al. teaches either doing stepwise increases or more gradual increases and it would have been obvious to one of ordinary skill in the art to determine through routine experimentation the optimum power change in terms of watts and time in order to produce the most desirable characteristics of the wafer product.

Conclusion


THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 703-305-4545. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on 703-308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.


Luz L. Alejandro
Primary Examiner
Art Unit 1763

August 14, 2003